SERIES 120
ANALOG SETPOINT CONTROLLERS

MODEL 121L Limitrol Shown

To set the Limitrol, rotate the Knob until the hole in the Knob lines up with another hole in the Setpoint Adjust Disc underneath. Push a 3/32" rod, or equivalent, into both holes as far as it can go. Hold the rod in firmly and rotate both Knob and Disc.

RESET PUSHBUTTON ON LIMITROL — Press to reset Limitrol after excess temperature drops below setpoint.

GREEN LAMP — Glows to indicate Output 2 is on. Indicate CW on actuator controller. Inoperative in single output models.

AMBER LAMP ON CONTROLLERS — Glows to indicate Output 1 is on. Indicates CCW on actuator controller.

OR

RED LAMP ON LIMITROL — Steady glow indicates selected setpoint is exceeded.

SETPOINT POINTER WITH BULLSEYE

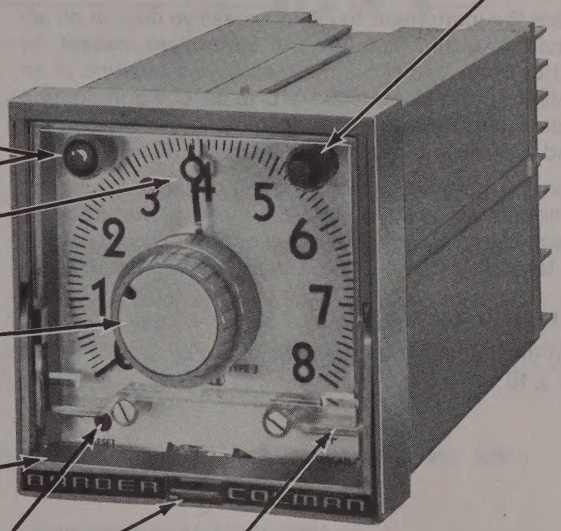
SETPOINT KNOB — On Dual Output Controllers this is Output 1 Setpoint. Pull to set.

PROCESS METER POINTER

CONTROL ACCESS DOOR — To reach these controls, swing top of door forward and down.

Manual Reset Action compensates for plus and minus load variations.

LATCH HANDLE — Push tab down to release Latch Handle. Thumb spaces under Latch Handle allow handle to be pulled forward and up. A cam action will then cause Controller to move forward.



SPREAD Adjustment — On Dual Output Plastic Extruder Temperature Controllers (122H and 125H) this is the Cooling Limit Adjustment which is continuously adjustable to limit the percent on time between 0 and 100%.

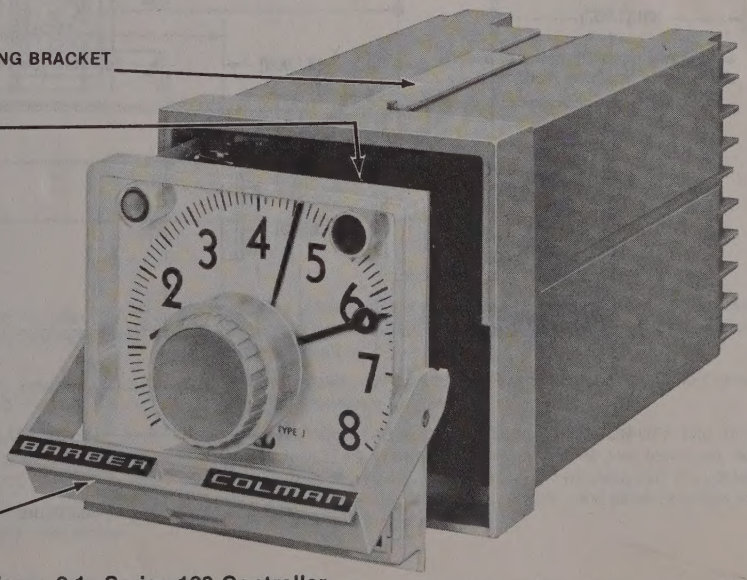
On Models 122R and 125R, this is the Deadband Control, which is adjustable from 1/4% (fully CCW) to 7% (fully CW).

Separates the two outputs of a dual output general purpose controller (12XJ, E, U) from – 10% to + 10% of span from the setpoint selected on the Output 1 setpoint.

TOP MOUNTING BRACKET

INTEGRAL AND DERIVATIVE ACTIONS SWITCH (Located on Board)

	Slideswitch Position S1	
	LEFT ⟷	RIGHT
Integral Action In Repeats/Minute	0.07	0.16
Derivative Action (Rate Time) In Minutes	2.7	1.0



Latch Handle pulled forward and up allowing access to the Integral and Derivative Actions Switch

Figure 2-1. Series 120 Controller

2.1 AFTER UNPACKING

This instrument has been inspected and packed at the factory. Check the contents of the shipping container against the packing slip. If the equipment is damaged in transit, report the extent of the damage to the carrier immediately. Repack in the original box until ready for installation. Any instructions given on tags attached to the instrument should be followed and then the tags should be removed. Handle with care.

2.2 MOUNTING (Figure 2-2)

Locate the instrument to avoid excessive dust or oil accumulations, and moisture. All controllers, except for Control Form Y, can be mounted in any position in an ambient temperature within 5°C to 55°C. For mounting Output Control Form Y, see the last page of this manual. Avoid furnace walls and other sources of radiant heat.

Minimum practical center to center distance for mounting controllers is 100 mm [3.937 inches]. This distance allows 4 mm [.157-inch] between controller front panels, and takes into consideration the mounting bracket.

2.3 POWER WIRING (Figure 2-3)

Input line voltage must be either 120 Vac ±10% or 240 Vac ±10%, 50 or 60 Hz.

2.4 INPUT WIRING AND CONTROL WIRING (Figures 2-3, 2-4, 2-5, 2-6 and 2-7)

Do not place power wiring and thermocouple wiring in the same conduit or wiring trough. The wires from several thermocouples may be in the same conduit or wiring trough.

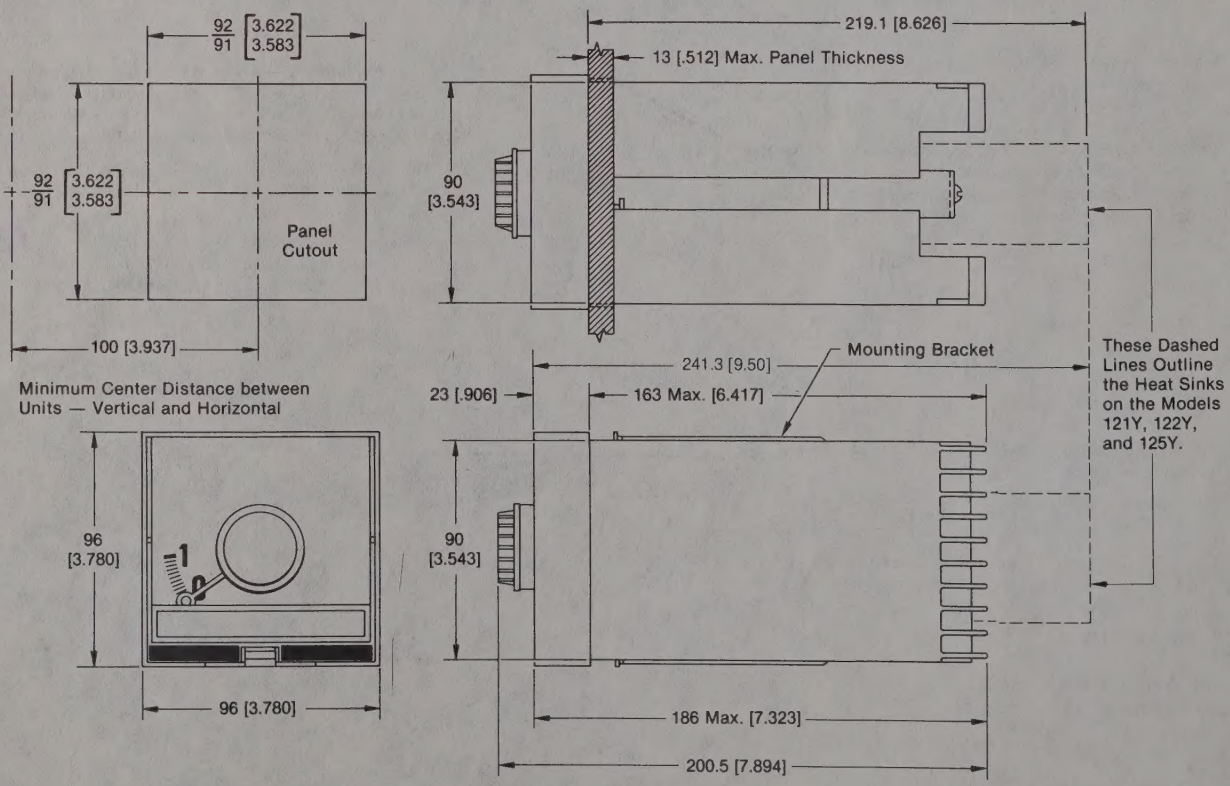
If shielded thermocouple leads are used, the shields should be insulated electrically and terminated at one location, preferably the chassis of the Series 120.

When the Series 120 is ordered, the type of thermocouple desired is specified. The Barber-Colman Thermocouple Catalog lists a complete selection of thermocouple assemblies and thermocouple extension leadwire. Thermocouples should never be wired to the Series 120 with ordinary copper wire. Wire only with thermocouple extension leadwire such as that specified in the Barber-Colman Catalog.

Observe the correct thermocouple and thermocouple extension wire polarity. The negative wire of both is usually coded red.

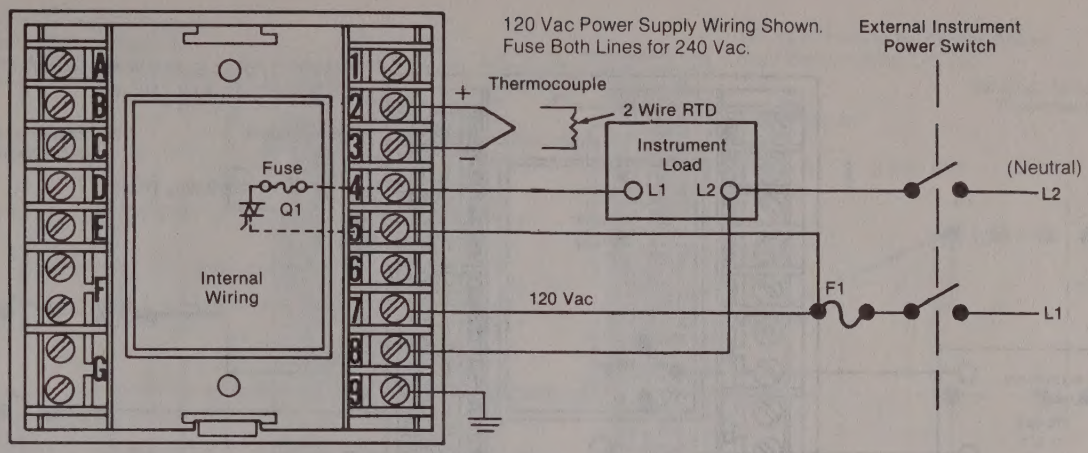
Signal Input Terminals 2 and 3 are for any input signal — observe polarity. For RTD sensors there is no polarity to observe. For three wire RTD's, connect the two WHITE wires of the RTD together.

All Dimensions are in Millimeters with Inches Following in Brackets.



Dimensions guaranteed only if this figure is certified.

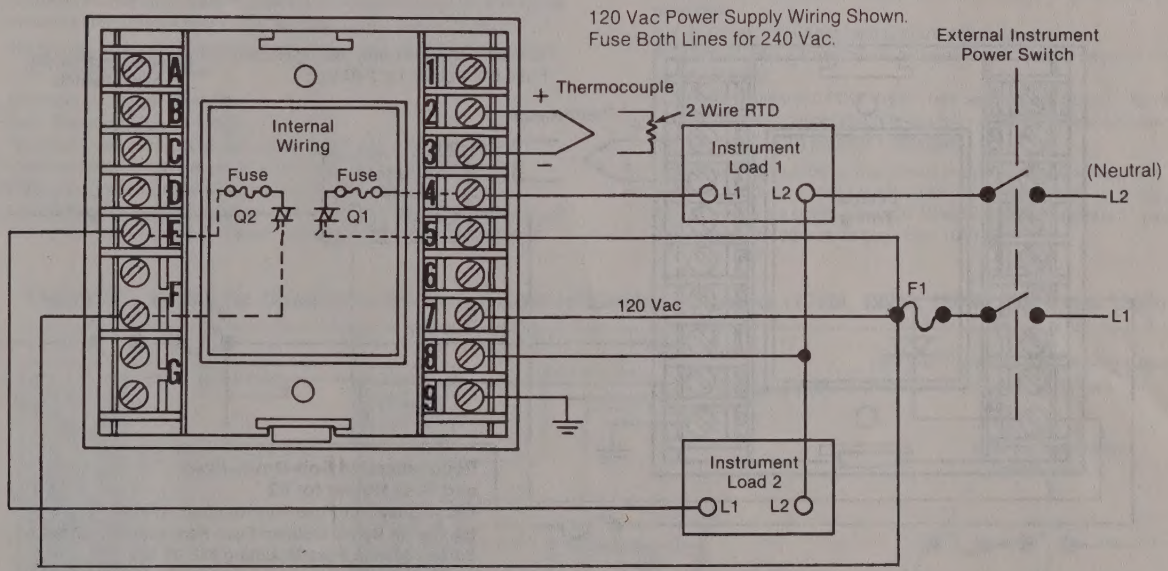
Figure 2-2. Mounting Dimensions



NOTES:

1. Instrument power switch and instrument fuses are included for illustrative purposes only. Consult local codes and appropriate wiring standards.
2. For 240 Vac operation, L1 is connected to terminal 6. For 120 Vac operation, L1 is connected to terminal 7.
3. To operate load from a different power source than instrument, terminal 5 is connected to separate power source L1 in phase with the instrument power supply. Instrument signal light will not operate unless instrument L2 and instrument load L2 are connected as shown. Instrument signal light will not operate if LOAD L1 is powered by a separate source of less than 100 Vac RMS.
4. Instrument load may be either a contactor coil, a Barber-Colman solid state contactor, or heater.
5. Rating of Solid State Switching Output (both ON-OFF and Time-Proportioning): 1A continuous, 10A inrush, 50 mA minimum. Any voltage from 24 Vac to 240 Vac can be switched, but the voltage switched must be the same phase and have the same common line as the instrument power supply.

Figure 2-3. Wiring for Single Solid State Switching Output Models (121A, 122B, 122V, 125B, and 125V)

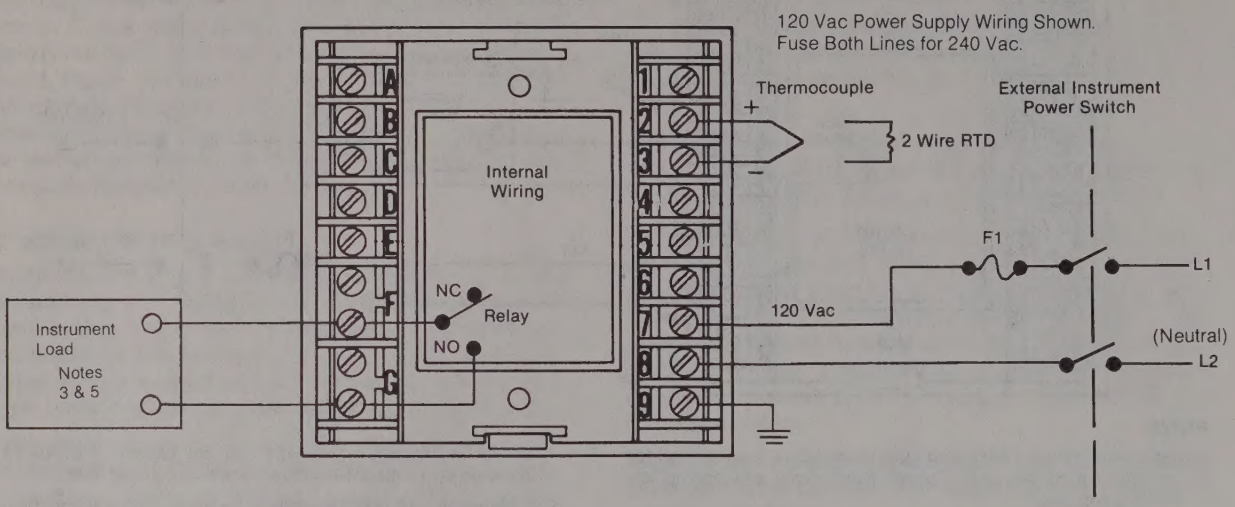


NOTES:

1. Instrument power switch and instrument fuses are included for illustrative purposes only. Consult local codes and appropriate wiring standards.
2. For 240 Vac operation, L1 is connected to terminal 6. For 120 Vac operation, L1 is connected to terminal 7.
3. To operate loads from a different power source than instrument, terminals 5 and/or F are connected to separate source L1.

   The separate power source must be in phase with the instrument power supply. Instrument signal light will not operate unless instrument L2 and instrument load L2 are connected as shown. Instrument signal light will not operate if LOAD L1 is powered by a separate source of less than 100 Vac RMS.
4. Instrument load may be either a contactor coil, a Barber-Colman solid state contactor, or heater.
5. Rating of Solid State Switching Output (both ON-OFF and Time-Proportioning): 1A continuous, 10A inrush, 50 mA minimum. Any voltage from 24 Vac to 240 Vac can be switched, but the voltage switched must be the same phase and have the same common line as the instrument power supply.

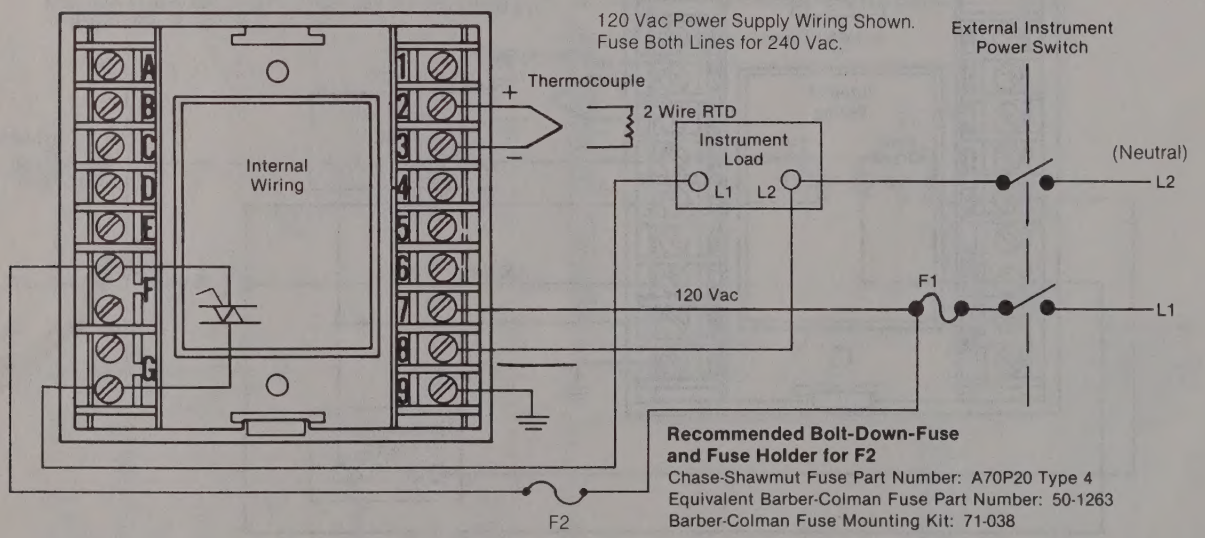
Figure 2-4. Wiring for Dual Solid State Switching Output Models (121J, 122E, 122U, 125E, 122H, 125H, and 125U)



NOTES:

1. Instrument power switch and instrument fuses are included for illustrative purposes only. Consult local codes and appropriate wiring standards.
2. Limitrol Relay Contact Ratings: 10A at 120 Vac; 5A at 240 Vac.
3. Power connections for load are made at the discretion of the installer.
4. For 240 Vac operation, L1 is connected to terminal 6. For 120 Vac operation, L1 is connected to terminal 7.
5. When limit is exceeded or power is interrupted, relay is in de-energized state.

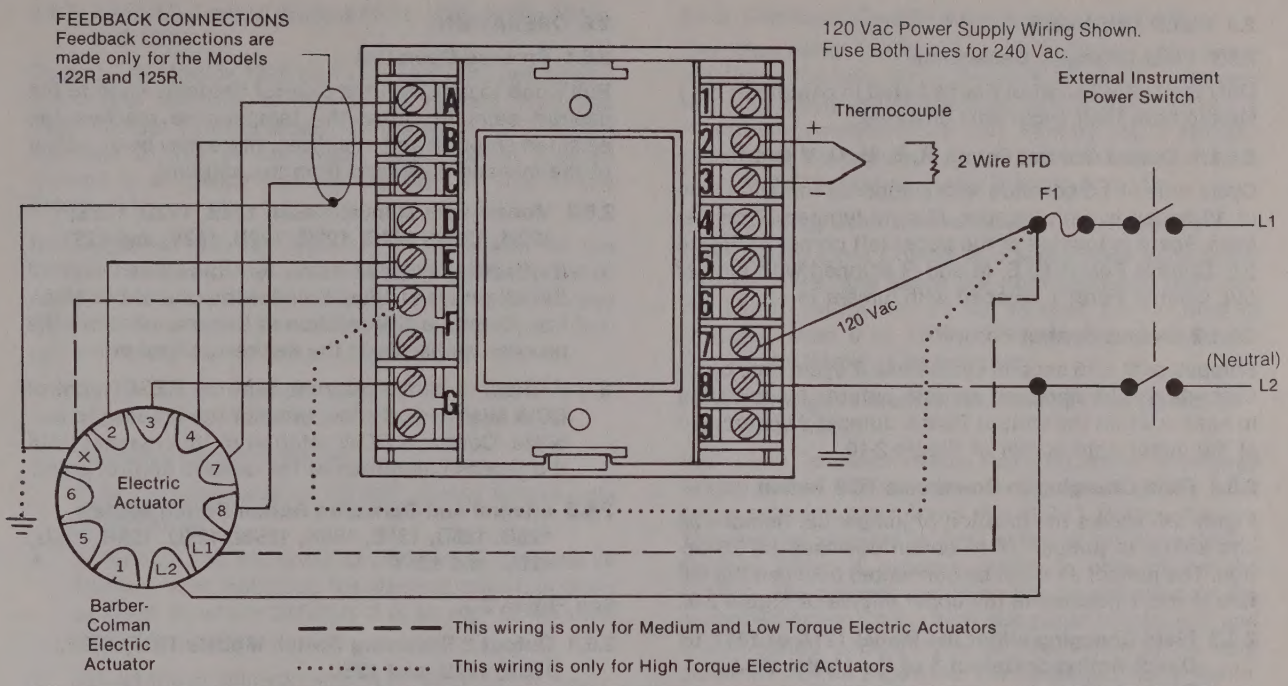
Figure 2-5. Wiring for Limit Controller (121L and 121T)



NOTES:

1. Instrument power switch and instrument fuses are included for illustrative purposes only. Consult local codes and appropriate wiring standards.
2. For 240 Vac operation, L1 is connected to terminal 6. For 120 Vac operation, L1 is connected to terminal 7.
3. To operate load and instrument from a different power source, terminal 5 is connected to separate power source L1 in phase with the instrument power supply. Instrument signal light will not operate unless instrument L2 and instrument load L2 are connected as shown. Instrument signal light will not operate if LOAD L1 is powered by a separate source of less than 100 Vac RMS.
4. Instrument load may be either a contactor coil, a Barber-Colman solid state contactor, or heater.
5. Rating of Solid State Switching Output: 10A (120 Vac); 8A (240 Vac); 1A minimum. Any voltage from 24 Vac to 240 Vac can be switched, but the voltage switched must be the same phase and have the same common line as the instrument power supply.

Figure 2-6. Wiring for Single 10A Switching Controller Models (121Y, 122Y, and 125Y)

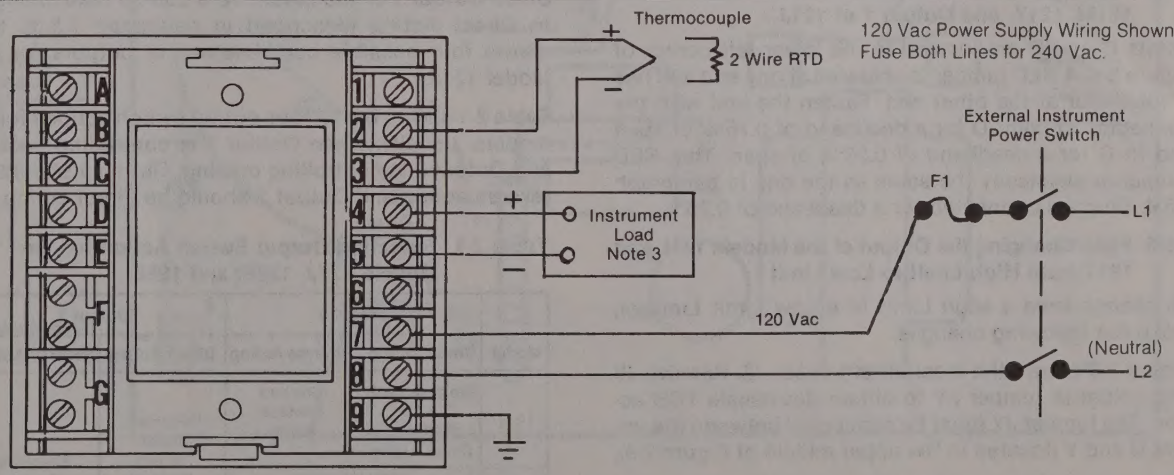

FEEDBACK CONNECTIONS
Feedback connections are made only for the Models 122R and 125R.
120 Vac Power Supply Wiring Shown.
Fuse Both Lines for 240 Vac.
External Instrument Power Switch
Thermocouple
2 Wire RTD
F1
L1
120 Vac
(Neutral)
L2
Electric Actuator
Barber-Colman Electric Actuator
This wiring is only for Medium and Low Torque Electric Actuators
This wiring is only for High Torque Electric Actuators

Wiring is for CCW Rotation on Call for process variable increase. For CW Rotation, Interchange Controller Terminals E and G; and, Terminals A and C.

NOTES:

1. Instrument power switch and instrument fuses are included for illustrative purposes only. Consult local codes and appropriate wiring standards.
2. For 240 Vac operation, L1 is connected to terminal 6. For 120 Vac operation, L1 is connected to terminal 7.
3. Controllers for Electric Actuators:
   Relay Switching Output Ratings
   Resistive Load: 2.5A at 120 Vac, 1.25A at 240 Vac.
   Inductive Load: 1.75A maximum at 240 Vac, 200 VA maximum.
   Correct ratings are based on a 15 second relay cycle time.
   Triac Switching (122R and 125R): — 1.5A, 24 to 240 Vac, 50mA minimum. .5 Vdc reference voltage available for 100 to 1000 ohm actuator slidewire.
4. 121: Closed circuit between E and F above setpoint.
   122 and 125: Closed circuit between E and F above positive proportional band limit.
   121M: Closed circuit between G and F below setpoint.
   122M and 125M: Closed circuit between G and F below negative proportional band limit.
   For R control forms and CCW on call of process variable increase, terminal A is 100% slidewire connection; terminal B is center tap slidewire connection; and terminal C is 0% slidewire connection.
5. Slidewire wiring must be run in a conduit separate from AC wiring. If this is not practical, use 3-conductor shielded cable. Ground the shield at the Actuator. Do Not ground the shield at the 120. Minimum conductor size is 22 gage for distances up to 100 feet, 18 gage over 100 feet.

Figure 2-7. Wiring for Controllers for Barber-Colman Electric Actuators (121M, 122M, 125M, 122R, and 125R)



NOTES:

1. Instrument power switch and instrument fuses are included for illustrative purposes only. Consult local codes and appropriate wiring standards.
2. The constant current outputs of these controllers are short circuit proof.
3. Current Output 4-20 mAdc Reverse Acting into 750 ohms or less.

Figure 2-8. Wiring for Single Current Output Models (122D, 125D and 122Q, 125Q)

2.5 FIELD CHANGES

2.5.1 Field Changing Cycle Time

Only the Output Control Forms listed in paragraph 2.5.1 should have their cycle time changed.

2.5.1.1 Output Control Forms B, E, M, U, V and Y

Cycle time of 1.5 seconds with Jumper J7 in. Cycle time of 15 seconds with Jumper J7 out. Jumper J7 on the Main Board is located at the upper left corner of Figure 2-9. Control Forms B, E, M and R shipped with jumper out. Control Form Y shipped with jumper in.

2.5.1.2 Output Control Form H

Shipped with a 15 second cycle time. A cycle time of 1.5 seconds can be obtained on both outputs by soldering in jumper J1 on the Output Board. Jumper J1 is located at the upper right corner of Figure 2-10.

2.5.2 Field Changing to Downscale TCB Action

Figure 2-9 shows the location of jumper J8. Remove J8 and solder in jumper JY to obtain downscale TCB action. The jumper JY must be connected between the letters U and Y (located in the upper middle of Figure 2-9).

2.5.3 Field Changing either the Model 121A or 121Y to Direct Acting or Output 1 of the Model 121J to Direct Acting

See Figure 2-9. First remove jumpers J4 and J5. J4 and J5 are located at the left side of Figure 2-9. Next, jumpers JX and JZ must be soldered in. Figure 2-9 shows where jumpers JX and JZ must be soldered in.

2.5.4 Field Changing Gain on Models 122B, 122E, 125B, 122D, 125D, 125E, 122H, 125H, 122M, 125M, 122Q, 125Q, 122R, 125R, 125U, 125V, 122Y and 125Y

Points C and D are located in the lower left corner of Figure 2-9. A RED jumper is soldered at one end and has a connector at the other end. Fasten the end with the connector to point D for a gain of 10 (P.B. of 10) and to C for a gain of 33 (P.B. of 3). Shipped connected for a gain of 33.

2.5.5 Field Changing Deadband on the Models 121A, 121M, 121Y, and Output 1 of 121J

Points C and D are located in the lower left corner of Figure 2-9. A RED jumper is soldered at one end and has a connector at the other end. Fasten the end with the connector to point D for a deadband of 0.75% of span and to C for a deadband of 0.25% of span. This RED jumper is physically the same as the one in paragraph 2.5.4. Shipped connected for a deadband of 0.75%.

2.5.6 Field Changing the Output of the Models 121L and 121T from High Limit to Low Limit

To change from a High Limit to a Low Limit Limitrol, make the following changes.

Figure 2-9 shows the location of jumper J8. Remove J8 and solder in jumper JY to obtain downscale TCB action. The jumper JY must be connected between the letters U and Y (located in the upper middle of Figure 2-9).

Next, remove jumpers J4 and J5. J4 and J5 are located at the left side of Figure 2-9. Next, jumpers JX and JZ must be soldered in. Figure 2-9 shows where jumpers JX and JZ must be soldered in.

2.6 OPERATION

2.6.1 Process Operation

Pull Knob to set. Turn the Control Setpoint Knob to the desired setpoint. After the temperature reaches the selected setpoint and stabilizes, there may be an offset of the measured variable from the setpoint.

2.6.2 Models with Manual Reset: 122B, 122D, 122E, 122H, 122M, 122Q, 122R, 122U, 122V, and 122Y

1. If offset is below setpoint, turn the RESET control CW slightly and allow time for the process to stabilize. Continue CW rotation in this manner until the process stabilizes at the desired control point.
2. If offset is above setpoint, turn the RESET control CCW slightly and allow time for the process to stabilize. Continue CCW rotation in this manner until the process stabilizes at the desired control point.

2.6.3 Integral and Derivative Action Switch Models 125B, 125D, 125E, 125H, 125M, 125Q, 125R, 125U, 125V, and 125Y

See Figure 2-1.

2.6.4 Output 2 Reversing Switch Models 121J, 122E, 125E, 122U, and 125U

OUTPUT 2 is an ON-OFF switching output. OUTPUT 2 can be turned on by either an increasing (direct acting) or decreasing (reverse acting) input signal to the controller by means of a slideswitch. This Output Reversal Switch is located on the Output 2 Board. Usually the Output Reversal Switch is set to the FRONT position so that OUTPUT 2 is turned on when the input signal to the controller is increasing.

To have OUTPUT 2 turned on by an increasing input signal to the controller, push the Reversing Switch towards the front of the controller. To have OUTPUT 2 turned on by a decreasing input signal to the controller, push the Reversing Switch towards the back of the controller.

There is no interaction between the SPREAD control and the Output Reversal Switch. Each is set independently.

Since Output 1 of the Model 121J can be field changed to Direct Acting (described in paragraph 2.5.3), this allows four possible combinations of outputs for the Model 121J.

Table 2-1 shows the various output switch actions for all models. Usually, when Output 1 is controlling heating and Output 2 is controlling cooling, Output 1 should be reverse acting and Output 2 should be direct acting.

Table 2-1. Selecting Output Switch Action for the Models 121J, 122E, and 125E

<table>
<tr><th rowspan="2">Model</th><th colspan="2">Output 1</th><th colspan="2">Output 2</th></tr>
<tr><th>Direct Acting</th><th>Reverse Acting</th><th>Direct Acting</th><th>Reverse Acting</th></tr>
<tr><td>121J</td><td>See paragraph 2.5.3 to change to Direct Acting</td><td>Shipped Reverse Acting</td><td rowspan="3">Reversing Switch Towards Front of Panel

Shipped Direct Acting</td><td rowspan="3">Reversing Switch Towards Back of Panel</td></tr>
<tr><td>122E
125E</td><td colspan="2">Fixed at Reverse Acting</td></tr>
<tr><td>122U
125U</td><td colspan="2">Fixed at Direct Acting</td></tr>
</table>

2.6.5 SPREAD Control Models 121J, 122E, 125E, 122U, and 125U

Output 1 of Models 122E and 125E is a time-proportioning output identical to that of the Models 122B and 125B. Output 1 of the Model 121J is an ON-OFF output identical to that of the Model 121A. Output 2 of all models is an ON-OFF output identical to that of the Model 121A.

Separation of the two outputs is adjustable by the SPREAD setpoint from −10% (CW) to +10% (CCW) of span from the setpoint selected for Output 1. CW moves Output 2 downscale from setpoint 1. CCW moves Output 2 upscale from setpoint 1. Proceed as follows:

1. Connect a dc millivolt source (the output of a B-C portable Potentiometer) to the input terminals.
2. Turn instrument power on.
3. Turn the front panel SETPOINT control to midscale temperature.
4. Determine the trip point of OUTPUT 2. Proceed as follows. Add (subtract) the desired deviation from setpoint at which OUTPUT 2 is to trip, to the midscale temperature.
5. Adjust the dc millivolt source for the millivolt equivalent of the temperature derived in step 4.
6. Adjust the SPREAD potentiometer until the front panel Green Lamp just turns on. Do not go beyond the turn-on point.

2.6.6 Deadband Control Models 122R and 125R

The Deadband Control is a screwdriver adjustment located in the hole above the word SPREAD. Deadband is continuously adjustable from 1/4% (fully CCW) to 7% of actuator rotation (fully CW). Factory set at nominal midspan. This control adjusts the deadband between CCW and CW rotation of the Electric Actuator.

2.6.7 Cooling Limit Control Models 122H and 125H

The Cooling Limit Control is a screwdriver adjustment located in the hole above the word SPREAD. The Cooling Limit Control can be set to limit the on time of Output 2 from 0 to 100%. This prevents excessively cooling the barrel of an extruder.

2.6.8 Placing the Models 121L and 121T in Operation (High Limit)

High Limit Operation means that the Limitrol is Reverse Acting Wired. All operation is by means of the front panel setpoint control and the RESET Pushbutton S1. The desired setpoint is first selected on the setpoint control. When a process meter is ordered on the Limitrol, the process condition can be observed on the calibrated scale. On start-up rear panel terminals F and G are shorted. Should the setpoint selected by the front panel control be exceeded, the Red Limit Lamp lights, rear panel terminals F and G are opened. The Limitrol remains in this condition until the process variable is again below setpoint and the front panel RESET Pushbutton is pressed.

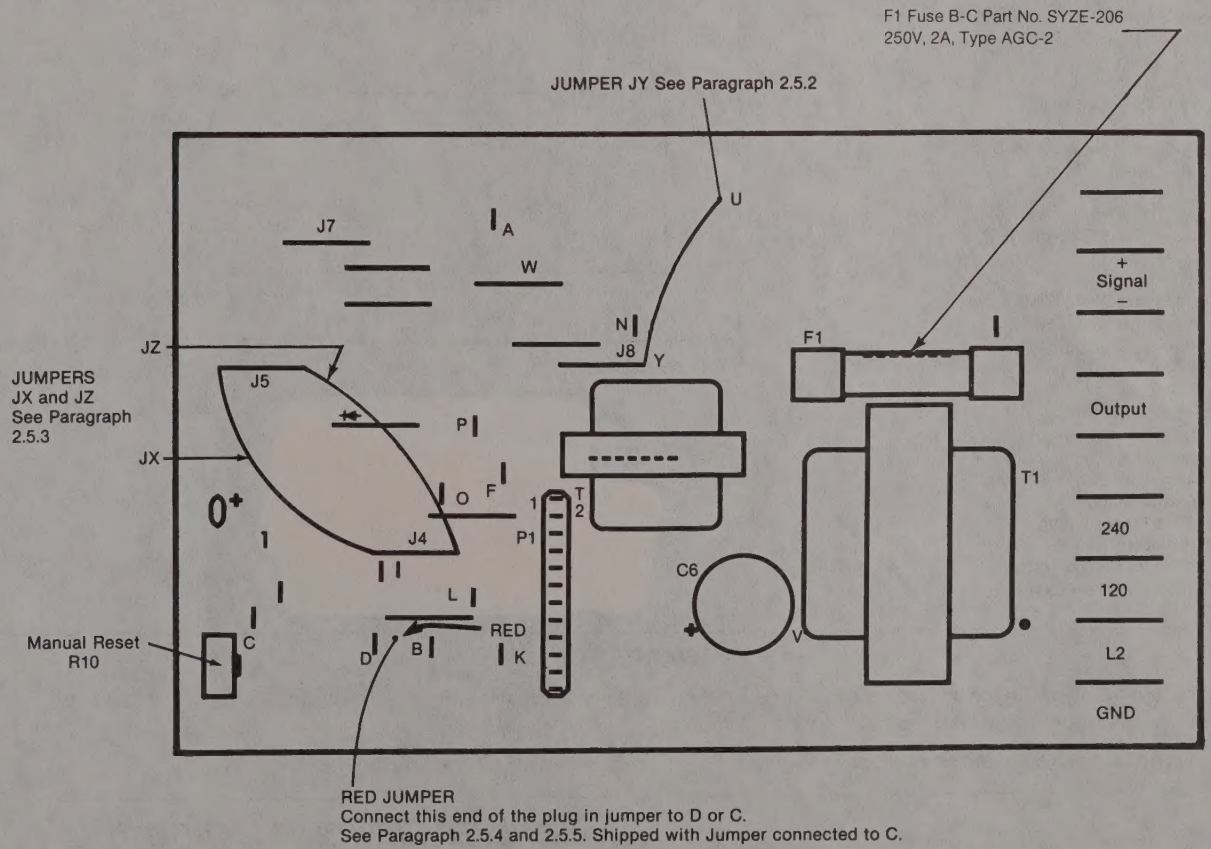


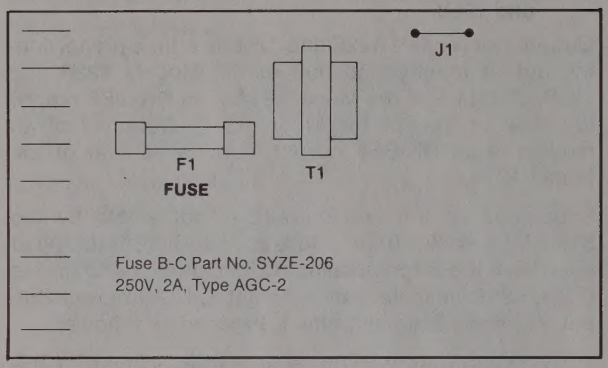
Figure 2-9. Main PCB Parts Location, All Models, Ignore Parts Not on Your Model

Table 2-2. Output Control Form Y, Load Rating Chart

Mounting Position	Thermal Limits Rating, Resistive Load	120 Vac Resistive Load	240 Vac Resistive Load
Front Panel either Vertical or tilted upward or downward up to 45°	10 Amperes at 0 to 55°C	10 Amperes, 1.2 kW	8.3 Amperes, 2 kW
Front Panel Horizontal and facing upward	7 Amperes at 0 to 55°C	7 Amperes 840 W	7 Amperes, 1.68 kW

At 25°C, the Thermal Limits Rating may be exceeded by 20% for one half hour.

Figure 2-10. Output Board, Output Control Form H



MODEL NUMBER CODE

WRITE THE ENTIRE 15-DIGIT CODE WHEN ORDERING

12 X X - X XXXX - X X X - 1 - XX

Series

Control Mode
- 1 — On-off or Limitrol (only with A, J, L, M, or Y below)
- 2 — Proportional with manual reset
- 5 — Proportional plus Selectable Integral plus Derivative

Output Control Forms
- A — On-off (1 ampere) (only with 121)
- B — Reverse Acting, Time Proportioning (1 ampere)
- D — 4-20 mAdc Reverse Acting
- E — Dual Reverse Acting, Time Proportioning and on-off auxiliary output
- H — Dual—Time Proportioning
- J — Dual—On-off
- L — Limitrol
- M — Relay Switching SPDT
- Q — 4-20mAdc Direct Acting
- R — Electric Actuator Positioning, Proportioning Feedback
- T — Auto Start Limitrol
- U — Dual Direct Acting, Time Proportioning and on-off auxiliary output
- V — Direct Acting, Time Proportioning (1 ampere)
- Y — 10 Amperes (120 Vac); 8 Amperes (240 Vac)

Setpoint
- 1 — Analog

Range Code

Four Digit Range Code

Input Signal
- 0 — Thermocouple Upscale TCB
- 1 — Thermocouple Downscale TCB
- 2 — RTD
- 4 — Vdc (above 0.1 Vdc)
- 5 — mAdc
- 8 — mVdc (below 100 mVdc)

Readouts
- 0 — None
- 3 — Process Meter

Housing
- 1 — Panel mount (standard)
- 2 — Less Housing

Specials

www.manualsplus.com
1015211

WARRANTY

This product is warranted according to the General Warranty Statement that is part of the Terms and Conditions of Sale of the Industrial Instruments Division, Barber-Colman Company.

The warranty for this product is effective for TWO YEARS AFTER SHIPMENT from Barber-Colman Company.

Barber-Colman Company
INDUSTRIAL INSTRUMENTS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940